(2010-48) Modeling Atmospheric Mercury Deposition to the Great Lakes :

Template Description: This project will use the NOAA HYSPLIT atmospheric fate and transport model to estimate the amount of atmospheric mercury deposited to the Great Lakes, and will also estimate the amounts coming from different source regions and source types. This information will be useful in prioritizing local, regional, national, and international actions to reduce mercury loadings to the Great Lakes.

Purpose: To estimate the amount of atmospheric mercury deposited to the Great Lakes and the amounts coming from different source regions and source types

Statutory Authority: P.L. 111-88, the Interior, Environment and Related Agencies Appropriations Act, 2010

Description of Work:

Mercury contamination in the Great Lakes is an ongoing concern, with both public health and wildlife health impacts. Atmospheric deposition likely contributes more mercury to the Lakes and their watersheds than any other loading pathway. However, the amount, form, spatial distribution, and source attribution for this deposition is not well known. In this project, mercury released to the air from local, regional, national, and global sources will be modeled from emissions to eventual deposition. The modeling will be carried out using a special version of the NOAA HYSPLIT atmospheric fate and transport model enhanced to simulate atmospheric mercury. Gridded meteorological data from NOAA and other agencies will be used to drive the HYSPLIT model. Mercury emissions inventories from EPA, States, and international agencies / institutions will be used as inputs to the model. The model output will be "checked" by comparison with all available ambient atmospheric mercury measurements in the region. The results of the modeling analysis will include the spatial and temporal variation of mercury deposition to the Great Lakes (including watersheds) and quantitative estimates of the relative importance of different source types and source regions to this deposition.

This project is closely related to previous atmospheric mercury modeling work successfully carried out by NOAA ARL, as described for example, in the 2007 NOAA Report to Congress on Mercury Contamination in the Great Lakes[1]. Relative to the Great Lakes analysis for 1999 described in that report, the work proposed here would represent an update (to a more recent year, e.g., 2005 or later), an extension (global sources and natural sources will now be included), and a refinement (new information on mercury's atmospheric chemistry and deposition processes will be incorporated). In addition, this new work will benefit from the much greater amount of ambient monitoring data available in recent years for "ground-truthing", relative to 1999. There are several legislative drivers for this work, including the Clean Air Act, which calls on NOAA – in collaboration with EPA and other agencies – to determine the sources of deposition of toxic pollutants to the Great Lakes and other critical areas.

Note that the HYSPLIT-based analysis proposed here would synergistically enhance other atmospheric modeling analyses being conducted for the Great Lakes region, should they also be carried out. The reasons for this positive synergism include: (a) resources can be shared between modeling analyses (e.g., emissions inventories, meteorological data sets, and ambient monitoring

[1] *NOAA Report to Congress on Great Lakes Mercury Contamination*. NOAA Oceanic and Atmospheric Research, Air Resources Laboratory. Authors: Mark Cohen, Roland Draxler, and Richard Artz. Submitted to Congress on May 14, 2007. Available from: http://www.arl.noaa.gov/documents/reports/NOAA_GL_Hg.pdf

data for evaluation) so each group does not have to "re-invent" the wheel for each set of required data; (b) The HYSPLIT model is optimized to create highly resolved source-receptor estimates, information that is less likely to be available from other models that are optimized for other purposes (e.g., CMAQ-Hg); (c) The model results can be compared and the similarities and differences can be analyzed to assess the robustness of the overall results (e.g., the results may be considered to be more "credible" if two independent models give comparable answers).

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Applicable Goals, Objectives, and Measures from Action Plan:

Focus Area 1: Toxic Substances and Areas of Concern

- Goal 1: The release of toxic substances in toxic amounts is prevented and the release of any or all persistent toxic substances (PTS) to the Great Lakes basin ecosystem is virtually eliminated.
- Goal 3: Environmental levels of toxic chemicals are reduced to the point that all restrictions on the consumption of Great Lakes fish can be lifted.
- Goal 4: The health and integrity of wildlife populations and habitat are protected from adverse chemical and biological effects associated with the presence of toxic substances in the Great Lake Basin.

Focus Area 5: Accountability, Education, Monitoring, Evaluation, Communication and Partnerships.

- Goal 1: A cooperative monitoring and observing system provides a comprehensive assessment of the Great Lakes ecosystem.

- Goal 2: The necessary technology and programmatic infrastructure supports monitoring and reporting, including Great Lakes Restoration Initiative project deliverables by all agencies and participating stakeholders. Data and information are provided in reports that are public friendly, timely and available on the Internet. Reports present integrated and scaled data from watersheds to lakes to Great Lakes basinwide.
- Goal 4: Accessible mechanisms provide a range of opportunities for Great Lakes stakeholders and citizens to provide input to the governments on Great Lakes issues and concerns.
- Goal 5: Work under the goals and objectives of the Great Lakes Water Quality Agreement is coordinated between the U.S. and Canada through Lakewide Management Plans (LaMP) and other binational processes, programs, and plans.
- Interim Objective: By 2014, timely data and information will be provided to decision makers at multiple scales within a framework of established baselines, targets, indicators of progress, and monitoring.

Milestones/Schedule, including deliverables:

Milestone/ Schedule	Quarter*
Configure model for Great Lakes analysis and make final decision on modeling time frame[m]	**1**
Assemble emissions inventory and meteorological data to be used as inputs to the atmospheric model[m]	**2**
Begin model simulations of atmospheric mercury with the HYSPLIT-Hg model[m]	**3**
Finish simulations with HYSPLIT-Hg model and conduct necessary post-processing analysis[m]	**4**
Comparison of model results with available atmospheric measurements in the Great Lakes region **[m]**	**4**
Complete estimate of amounts and source-attribution for deposition of mercury to the Great Lakes and Watersheds, and prepare a report documenting and describing the results **[d]**	**4**
[d] indicates deliverable [m] indicates milestone * quarter is relative to the time of the transfer of funds to NOAA, i.e., if the money is transferred in the 3rd Quarter of FY2010, then this is Quarter #1 in the table above.	

Budget:

(a) Personnel …… $ 83,484
(b) Fringe benefits …… $ 22,374
(c) Travel …… …$ 0
(d) Equipment …… .. $ 0
(e) Supplies …… $5,000
(f) Procurement/assistance
  a. Total funds being used on extramural agreements: …… $20,000
  b. Extramural agreements by type:
    i. Grants …… $ 0
    ii. Cooperative Agreement …… $ 0
    iii. Procurement (includes Small Purchase Order) … $20,000
(g) Construction ……..$ 0
(h) Other (training) …… $ 0
(i) Total Direct Charges ……$ 130,858
(j) Indirect Costs: Rate % Base ……$ 69,142